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Synergetic effects of yield attributes of finger millet (*Eleusine coracana*) varieties under mango based agroforestry system

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Abstract

The field experiment on synergetic effect of Yield attributes of Finger millet varieties under Mango based Agroforestry systems was carried out during Kharif 2025-26 at Agricultural Research Station, Chintamani, Eastern Dry Zone of Karnataka. The seven varieties of Finger millet (*Eleusine coracana*) viz. GPU-47, KMR-204, ML-365, GUU-67, MR-1, MR-6 and Local variety were tested as treatments for their Yield parameters (namely, Weight of Ear head, Weight of Dry Biomass, Test weight of the grain and Grain yield of Finger millet) at Two meter and Three meter distance from the base of Mango Eight years old orchards in North and South directions. The results revealed that the significant difference was observed among Finger millet varieties. The maximum weight of ear head was recorded with MR-1 (20.10 gm.plant⁻¹) followed by MR-6 (19.95 gm.plant⁻¹) and lowest ear head weight observed with KMR-204 (12.10 gm.plant⁻¹) under Mango based Agroforestry system at three meter distance in Southern direction and under open field condition the maximum ear head weight recorded with MR-1 (19.98 gm.plant⁻¹) followed by MR-6 (19.65) and least ear head weight recorded with KMR-204 (12.12 gm.plant⁻¹). Weight of dry biomass was found to be highest in MR-1 (4.16 gm.plant⁻¹) followed by MR-6 (3.73 gm.plant⁻¹) and least was recorded with KMR-204 (1.56 gm.plant⁻¹) under Mango based Agroforestry system at three meter distance in Southern direction. The test weight of the grains and grain yields were assessed. The Test Weight of Grain and Grain yield recorded maximum with MR-1 (3.42 gm.plant⁻¹, 3.36 gm.plant⁻¹, and 33.25 Qtl.ha⁻¹ respectively) under Mango based Agroforestry system at three meter distance in Southern direction. Test Weight of the grain and Grain yield was found to be maximum with MR-1 (18.43 gm.plant⁻¹, 3.36 gm.plant⁻¹, 3.21 gm.plant⁻¹ and 31.32 Qtl.ha⁻¹ respectively) under Mango based Agroforestry system at three meter distance in Southern direction. The synergetic effect due to the highest yield attributes of Finger millet varieties under Mango based Agroforestry system may be attributed to the presence of organic leaf litter and nutrient status of the soil and light incidence.

Keywords: Finger millet, variety, distance, north, south, mango, synergetic, agroforestry

Introduction

The most appropriate technique for optimising land production is the agroforestry land use system, which involves positive and negative interactions between its components in time and place, with woody perennials as one of the components. The system has the ability to supply society's wood-based demands while lowering pressure on natural forest resources and assisting in their long-term management. Adoption of agroforestry systems has resulted in reduced land degradation and greater productivity in many nations (Swaminathan, 1987) [9].

Agroforestry optimizes land productivity by involving positive and negative interactions between its components in time and space where woody perennials is one of the components. Agroforestry is a cultivation of woody perennials with arable crops. It is an alternative land use system (Baumer, 1991) [1] to meet the demand food and fuel for ever growing population. In this system forage and firewood yield from the alley components serves as an insurance against total crops failure due to aberrant weather and other conditions. The increased productivity of crop under the tree canopy was believed to be due to improved soil fertility (Young, 1989) [11]. Intercropping is a widely used agricultural system of cultivating two or more crops simultaneously in one field during the same

or part of their growing time. It has been proven that intercropping systems are more efficient in increasing system productivity by efficiently using farmland and limited resources due to temporal and spatial inter specific complementary (Gupta *et al*, 2017) ^[5]. The performance of different crops under different agroforestry system studied by various workers. However, performance of finger millet varieties under Mango based agroforestry system received little attention, hence the present study entitled “Studies on growth and yield attributes of Finger millet (*Eleusine coracana* L.) under Mango based Agroforestry systems in Eastern Dry Zone of Karnataka” has been carried out with the objective to evaluate the Synergetic effect of Yield performance of Finger millets under Mango intercropping systems.

Materials and Methods

The study was conducted during 2024–25 in a well-established seven year old Mango plantations at Agricultural Research Station (ARS), College of Sericulture campus, Chintamani, Chikkaballapur district, University of Agricultural Sciences, Bangalore, which is located at 13.4355° N latitudes and 77.7315° E longitude. The experiment plot size of 24 × 56 m (1344 m²) which consists of Mango trees with spacing of 8 m X 8 m and seven finger millet varieties as intercrop viz., GPU-48, KMR-204, ML-365, GPU-67, MR-1, MR-6 and Local variety with spacing of 25×10 cm.

Experimental details and Design: Design: The experiment

followed a Randomized Block Design (RBD). Treatments: Seven different treatments (Finger millet varieties) were applied to evaluate the growth and yield attributes. Replications: Each treatment was replicated three times.

Details of treatment

Treatments	Under Mango	Open Field
T ₁	Mango + GPU-48	GPU-48
T ₂	Mango + KMR-204	KMR-204
T ₃	Mango + ML-365	ML-365
T ₄	Mango + GPU-67	GPU-67
T ₅	Mango + MR-1	MR-1
T ₆	Mango +MR-6	MR-6
T ₇	Mango+Local variety	Local variety

Yield Parameters Recorded: Weight of Ear head (g/plant), Weight of Dry Biomass (g/plant), Test Weight of grain (g/plant) and Grain Yield (q/ha).

Statistical Analysis: Data was analyzed using analysis of variance (ANOVA) to determine statistical significance. Mean values were compared using the critical difference (CD) method. Microsoft Excel and OPSTAT software were used for evaluation and interpretation

Results and Discussion

Table 1: Yield Parameters (Weight of Ear Head and weight of Dry Biomass) of Finger millet varieties at harvest in different direction and open field under Mango based Agroforestry system

Treatment	Weight of Ear head (g/plant)					Weight of Dry Biomass (g/plant)				
	South		North		Open Field	South		North		Open Field
	D1	D2	D1	D2		D1	D2	D1	D2	
GPU-48(T ₁)	16.52	17.43	16.33	17.34	16.1	2.21	2.67	2.12	2.54	1.98
KMR-204(T ₂)	12.43	13.54	12.1	13.23	12.12	1.35	1.67	1.24	1.56	1.48
ML-365(T ₃)	15.12	15.98	14.96	15.62	14.78	1.42	1.78	1.39	1.74	1.52
GPU-67(T ₄)	15.42	16.13	15.56	16.24	15.21	1.52	1.81	1.37	1.78	1.62
MR-1(T ₅)	19.21	20.1	18.9	19.98	18.32	3.23	4.16	3.42	4.53	3.46
MR- 6(T ₆)	19.06	19.95	18.42	19.65	18.1	2.98	3.73	2.76	3.58	3.12
Local variety(T ₇)	14.38	15.75	14.23	15.53	14.56	2.23	2.67	2.1	2.54	2.4
SEm(±)	0.48	0.53	0.47	0.53	0.47	0.07	0.08	0.06	0.08	0.07
CD	1.48	1.63	1.46	1.63	1.44	0.2	0.25	0.19	0.24	0.21

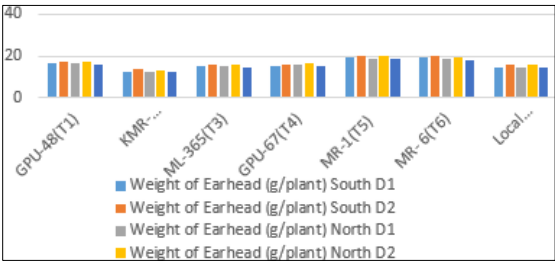


Fig 1: Yield attributes of Finger millet varieties under Mango Plantation

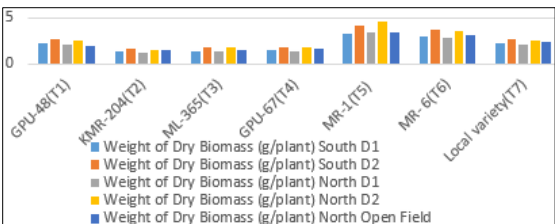


Fig 2: Yield attributes of Finger millet varieties under Mango Plantation

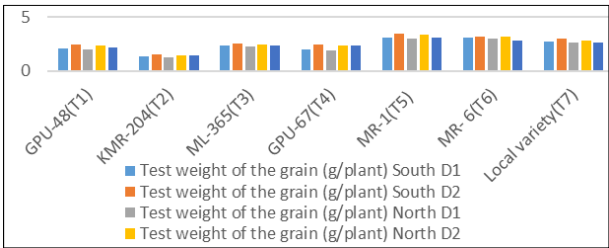


Fig 3: Yield attributes of Finger millet varieties under Mango Plantation

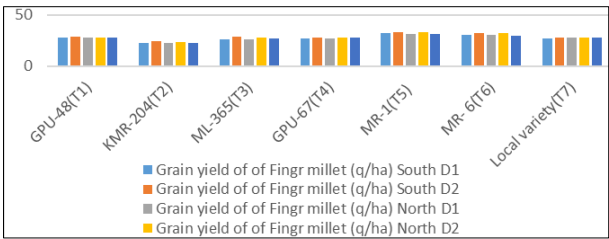


Fig 4: Yield attributes of Finger millet varieties under Mango Plantation

Weight of Ear Head

The weight of ear head per plant of finger millet was significantly influenced by the varieties grown under the mango-based agroforestry system. Among the varieties, MR-1 (T_5) recorded the highest ear head weight in all directions and distances from the mango tree, with values ranging from 18.90 to 20.10 g plant⁻¹ followed closely by MR-6 (T_6) which recorded 18.42 to 19.95 g plant⁻¹. The superior performance of these varieties indicates their better adaptability to the altered microclimatic conditions prevailing under the mango canopy. At the northern side the ear head weight increased from D1 to D2 across all varieties. MR-1 recorded the highest values of 19.21 g plant⁻¹ at D1 and 20.10 g plant⁻¹ at D2. Similarly, on the southern side MR-1 produced 18.90 g plant⁻¹ at D1 and 19.98 g plant⁻¹ at D2. The increase in ear head weight at D2 compared to D1 may be attributed to reduced competition for light, moisture, and nutrients with increasing distance from the mango trees. Among the varieties GPU-48 (T_1) and GPU-67 (T_4) also performed well, recording ear head weights above 15 g plant⁻¹ under most agroforestry situations. In contrast, KMR-204 (T_2) produced the lowest ear head weight, ranging from 12.10 to 13.54 g plant⁻¹. Under open-field conditions, MR-1 maintained the highest ear head weight (18.32 g plant⁻¹), whereas KMR-204 recorded the lowest value (12.12 g plant⁻¹) (Table 1 and Fig. 1). The differences among varieties were statistically significant. The higher ear head weight observed in MR-1 and MR-6 may be due to their superior genetic potential for assimilate production and partitioning towards reproductive structures resulting in larger and heavier ear heads. The difference of weight of ear head in MR 1 and MR 6 varieties was due to their varietal potential and their

genetic yielding ability, these are in conformity with the findings of Leila *et al.*, (2008) ^[6].

Weight of Dry Biomass

Significant variation was observed among finger millet varieties with respect to dry biomass production under the mango-based agroforestry system. The highest dry biomass accumulation was recorded by MR-1 (T_5) in both directions and distances, ranging from 3.23 to 4.53 g plant⁻¹. This was followed by MR-6 (T_6), which produced 2.76 to 3.73 g plant⁻¹. At the southern side, MR-1 recorded 3.23 g plant⁻¹ at D1 and 4.16 g plant⁻¹ at D2 while on the northern side it produced 3.42 g plant⁻¹ and 4.53 g plant⁻¹ at D1 and D2, respectively. The higher biomass production at D2 suggests that greater availability of solar radiation and reduced tree-crop competition enhanced vegetative growth. Among the remaining varieties, GPU-48 and the local variety produced moderate biomass, whereas KMR-204 (T_2) recorded the lowest biomass values, ranging from 1.24 to 1.67 g plant⁻¹. Under open-field conditions, MR-1 again recorded the highest biomass (3.46 g plant⁻¹) (Table 1 and Fig. 2), demonstrating its superior growth potential irrespective of the production environment. The superior biomass production of MR-1 and MR-6 could be attributed to their vigorous growth habit, efficient utilization of available resources, and greater tolerance to partial shade conditions commonly encountered in agroforestry systems. The dry matter production is an indicative of efficiency of varieties, it followed the pattern, in which it is distributed in different plant parts more towards the reproductive parts of the plant and these are in conformity with the findings of Das, (1991) ^[2] and Dera *et al.*, (2014) ^[3] in pearl millet.

Table 2: Yield Parameters (Test Weight and Grain Yield) of Finger millet varieties at harvest in different direction and open field under Mango based Agroforestry system

Treatment	Test Weight of grain (g/plant)					Grain Yield (q/ha)				
	South		North		Open Field	South		North		Open Field
	D1	D2	D1	D2		D1	D2	D1	D2	
GPU-48(T_1)	2.12	2.42	1.98	2.34	2.2	27.6	28.4	27.45	28.25	27.5
KMR-204(T_2)	1.38	1.54	1.31	1.48	1.45	22.45	23.87	22.28	23.65	22.5
ML-365(T_3)	2.32	2.53	2.26	2.46	2.36	26.25	28.36	26.22	28.1	27
GPU-67(T_4)	1.98	2.43	1.94	2.4	2.32	27.36	28.25	27.16	28.15	27.8
MR-1(T_5)	3.12	3.42	3.05	3.34	3.1	32.5	33.25	31.75	32.85	31.46
MR-6(T_6)	3.06	3.21	3	3.2	2.78	30.75	32.65	30.5	32	30
Local variety(T_7)	2.75	2.96	2.64	2.82	2.64	27.35	28.18	27.45	28.1	27.75
S.Em($\pm$)	0.07	0.08	0.07	0.08	0.07	0.83	0.91	0.82	0.91	0.83
CD	0.22	0.25	0.21	0.25	0.22	2.56	2.81	2.52	2.82	2.57

Test Weight of Grain per Plant (g)

The test weight of grain per plant of finger millet varieties grown under the mango-based agroforestry system presented in the Table 6 and Fig 7. Among the tested varieties, MR-1 (T_5) recorded the highest test weight across all directions and distances from the mango trees, with values ranging from 3.05 to 3.42 g plant⁻¹, followed by MR-6 (T_6), which recorded values between 2.78 and 3.21 g plant⁻¹. The higher test weight observed in these varieties indicates superior grain filling and efficient translocation of photosynthates to the developing grains. On the southern side, MR-1 recorded 3.12 g plant⁻¹ at D1 and 3.42 g plant⁻¹ at D2, while on the northern side it produced 3.05 g plant⁻¹ at D1 and 3.34 g plant⁻¹ at D2. Similarly, MR-6 recorded 3.06 g plant⁻¹ and 3.21 g plant⁻¹ at D1 and D2 respectively on the northern side. The higher values at D2 indicate that reduced competition from mango trees and better availability of growth resources favoured grain development. Among the remaining varieties, the local variety (T_7) and ML-365 (T_3) recorded moderate test weights, whereas

KMR-204 (T_2) exhibited the lowest values ranging from 1.31 to 1.54 g plant⁻¹. Under open-field conditions, MR-1 maintained the highest test weight (3.10 g plant⁻¹), while KMR-204 recorded the lowest (1.45 g plant⁻¹) (Table 2 and Fig. 3). The highest test weight could be obtained where the growing season is longest that is in MR 1 variety, these are in conformity with the findings of Doni *et al.*, (2019) ^[4]. The lower test weight in short duration varieties may be due to the shriveling of grain due to hot winds prevailed during the grain filling stage, results are in accordance with the findings of Maurya *et al.*, (2016) ^[7].

Grain Yield per Plant (q/ha)

Grain yield per plant differed significantly among the finger millet varieties under the mango-based agroforestry system. The highest grain yield was recorded by MR-1 (T_5) in all directions and distances, ranging from 31.75 to 33.25 qha⁻¹, followed by MR-6 (T_6), which recorded yields between 30.00 and 32.65 qha⁻¹. On the southern side, MR-1 recorded grain yields of 32.50 qha⁻¹ at

D1 and 33.25 qha⁻¹ at D2 while on the northern side it produced 31.75 qha⁻¹ and 32.85 qha⁻¹ respectively. Similarly MR-6 produced 30.75 qha⁻¹ at D1 and 32.65 qha⁻¹ at D2 on the southern side indicating better performance at greater distances from the mango trees. Among the improved varieties, GPU-48 (T₁), GPU-67 (T₄), ML-365 (T₃), and the local variety (T₇) recorded intermediate grain yields ranging from approximately 26.22 to 28.40 qha⁻¹. The lowest grain yield was observed in KMR-204 (T₂), which recorded values between 22.28 and 23.87 qha⁻¹. Under open-field conditions, MR-1 again recorded the highest grain yield (31.46 qha⁻¹) whereas KMR-204 recorded the lowest (22.50 qha⁻¹) (Table 4 and Fig. 4). The results indicate that MR-1 is the most suitable finger millet variety for cultivation under mango-based agroforestry systems due to its superior grain yield, test weight, and overall growth performance followed by MR-6. According to Sarvade *et al.*, (2014)^[8], the open farming approach had the best grain output (36.0q/ha). Verma and Rana, (2014)^[10] evaluated the performance of *Eucalyptus tereticornis* tree development and agricultural yields of rice and wheat. The grain production under tree cultivation (1.49t/ha) was lower than that of open culture. Sarvade *et al.*, (2014)^[8] conducted a wheat experiment under Poplar and discovered that crop output was lower under Poplar than sole cropping. This could be due to poplar's rapid growth, which affects on intercrops.

Summary

The experiment was to investigate the synergetic effect of yield parameters (weight of ear head, weight of dry biomass, test weight of the grains and grain yield) of finger millet under Mango based agroforestry systems. The weight of ear head at harvest was found significantly higher under Mango based agroforestry system. The weight of ear head recorded highest in MR 1 (20.1 g) followed by MR 6 (19.95 g) under Mango based agroforestry system. Under Open Field condition MR 1 (18.32 cm) followed by MR 6 (18.1cm) recorded maximum weight of ear head respectively. The dry biomass recorded highest in highest in MR 1 (4.16 g) followed by MR 6 (3.73 g) under Mango based agroforestry system. Under Open Field condition MR 1 (3.46 cm) followed by MR 6 (3.12 cm) recorded maximum weight of ear head respectively. The test weight of the grain recorded highest in MR 1 (3.42 g) followed by MR 6 (3.21 g) respectively under Mango based agroforestry system. Under Open Field condition MR 1 (3.1 cm) followed by MR 6 (2.78 cm) recorded maximum weight of ear head respectively. The grain yield at harvest was found significantly higher under Mango based agroforestry system. The grain yield recorded highest in MR 1 (33.25 q/ha) followed by MR 6 (32.65 q/ha) under Mango based agroforestry system. Under Open Field condition MR 1 (31.46 q/ha) followed by MR 1 (30.0 q/ha) recorded maximum weight of ear head respectively.



Plate 1: Recording of Yield parameters in Mango plantation



Plate 2: Ear heads of Finger millet varieties

Conclusion

From the study, it can be concluded that all the seven varieties performed better under Mango based Agroforestry system compared to Open Field. For agroforestry system, the varieties such as MR1 and MR 6 may be preferred for higher grain yield and GPU 48 for early harvest and good yield compared to KMR 204. The Yield parameters of seven Finger millet varieties performed better from three meter distance from the mango tree in Southern direction compared to Northern side of the tree from Two and Three meter distances.

References

1. Baumer M. Animal productivity, agroforestry and similar techniques. *Agroforestry Abstracts*. 1991;4(9):179-198.
2. Das LD. Quantitative responses of pearl millet to different sowing dates. *Mysore Journal of Agricultural Sciences*. 1991;25(2):169-174.
3. Dera J, Mpofu LT, Tavirimirwa. Response of pearl millet varieties to different dates of sowing at Makoholi and Kadoma Research Stations, Zimbabwe. *Academia Journal of Agricultural Sciences*. 2014;2(4):110-113.
4. Doni S, Niki E, Teresa F, Agustin M. Best practices in evaluation and restoration of degraded Mediterranean environments. *Monografias do Ibader*. 2019:547-924.
5. Gupta SM, Arora S, Mirza N, Pande A, Lata C, Puranik S, Kumar J, Kumar A. Finger millet: a "certain" crop for an "uncertain" future and a solution to food insecurity and hidden hunger under stressful environments. *Frontiers in Plant Science*. 2017;8:643.
6. Leila M, Khan FG, Yousafai HK. Response of millet varieties to different planting methods. *Sarhad Journal of Agriculture*. 2008;17:159-163.
7. Maurya SK, Nath S, Patra SS, Rout S. Effect of different sowing dates on growth and yield of pearl millet varieties under Allahabad condition. *International Journal of Plant Sciences*. 2016;7(1):62-69.
8. Sarvade S, Rahul S, Vikas G, Dilip SK, Babitha K. Agroforestry: an approach for food security. *Indian Journal of Ecology*. 2014;41(1):95-98.
9. Swaminathan MS. The promise of agroforestry for ecological and nutritional security. In: Steppler HW, Nair PKR, editors. *Agroforestry and decade of development*. Nairobi: ICRAF; 1987. p. 30.
10. Verma SK, Rana BS. Effect of light intensity on paddy and wheat grain yield under *Eucalyptus tereticornis* Sm. based agri-silvicultural system. *Indian Forester*. 2014;140.
11. Young A. *Agroforestry for soil conservation*. Wallingford (UK): International Council for Research in Agroforestry and CAB International; 1989. 229-233.